CLAIMS

What is claimed is:

1. An optical apparatus comprising:

a two dimensional array of modulator and/or detector pixels embedded in a flexible or deformable body, the modulator and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels; and

an optical arrangement for directing an incoming optical beam from an optical transmitter onto a selected one or ones of said modulator and/or detector pixels in said array and for returning light which is modulated and reflected by said pixels to an optical transmitter from which the incoming beam was directed to the optical arrangement.

2. The optical apparatus of claim 1 further including electronic equipment for sensing when light impinges on said pixels and for supplying data signals to said pixels to cause said pixels to reflect the impinging light in accordance with the data signals applied thereto.

3. The optical apparatus of claim 2 and an associated electrical matrix for connecting the modulator and/or detector pixels in said array to the electronic equipment.

4. The optical apparatus of claim 1 wherein the array of modulator and/or detector pixels is an array of Asymmetric Fabry-Perot Multiple Quantum Well devices.

5. The optical apparatus of claim 4 wherein the optical arrangement is a lens which focuses the incoming beam onto said selected one or ones of said modulator and/or detector pixels in said array.

6. The optical apparatus of claim 5 wherein the flexible or deformable body is a thermosetting material.

7. The optical apparatus of claim 6 wherein the flexible or deformable body is disposed in a hemispherical configuration.

8. The optical apparatus of claim 1 wherein the flexible or deformable body has a sheet-like polymer support element in which the two dimensional array of modulator and/or detector pixels are embedded.

9. The optical apparatus of claim 1 wherein the plastic support element is relatively plastic at temperatures above room temperature, thereby allowing the plastic support element and the array of modulator and/or detector pixels embedded therein to conform to a predetermined shape, while being relatively rigid at room temperature.

10. The optical apparatus of claim 1 wherein each modulator pixel comprises a plurality of AFP MQW devices.

11. The optical apparatus of claim 1 wherein each modulator pixel comprises at least one AFP MQW device and at least one optically activated switch connected in series with the at least one AFP MQW device.

12. The optical apparatus of claim 1 wherein each modulator pixel comprises at least one AFP MQW device and two optically activated switches connected in series with the at least one AFP MQW device.

13. The optical apparatus of claim 1 wherein the modulator and/or detector pixels are arranged in an array separated by pixel addressing electrodes arranged in a matrix, each modulator pixel having a pair of contacts for connection to separate adjacent addressing electrodes.

14. A passive optical repeater comprising:

a two dimensional array of modulator and/or detector pixels disposed in a predetermined configuration, the modulator and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels;

an optical arrangement for directing a first incoming optical beam from a first optical transmitter onto a first selected one or ones of said modulator and/or detector pixels in said array and for directing a second incoming optical beam from a second optical transmitter onto a second selected one or ones of said modulator and/or detector pixels in said array, the first incoming optical beam being modulated with data; and

an electronic apparatus for detecting the data on the first incoming optical beam and for modulating the second incoming beam at said second selected one or ones of said modulator and/or detector pixels in said array using said data;

wherein the second incoming beam is reflected at said second selected one or ones of said modulator and/or detector pixels via the optical arrangement back to said second optical transmitter.

15. The passive optical repeater of claim 14 wherein the two dimensional array of modulator and/or detector pixels is disposed in a hemispherical configuration.

16. The passive optical repeater of claim 14 wherein the electronic apparatus includes a back plane switch arrangement and a processor.

17. The passive optical repeater of claim 16 wherein the electronic apparatus includes a cache memory for temporarily storing received data from one source, the electronic apparatus modulating a beam from another source with the data stored in the cache.

18. An optical relay apparatus comprising:

a two dimensional array of modulator and/or detector pixels disposed in a predetermined configuration, the modulator and/or detector pixels responding

to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels;

an optical arrangement for directing a first incoming optical beam from a first optical transmitter onto a first selected one or ones of said modulator and/or detector pixels in said array and for directing a second incoming optical beam from a second optical transmitter onto a second selected one or ones of said modulator and/or detector pixels in said array, the first incoming optical beam being modulated with data; and

an electronic apparatus for storing the data on the first incoming optical beam in memory and for modulating the second incoming beam at said second selected one or ones of said modulator and/or detector pixels in said array using said data stored in said memory;

wherein the second incoming beam is reflected at said second selected one or ones of said modulator and/or detector pixels via the optical arrangement back to said second optical transmitter.

19. The optical relay apparatus of claim 18 wherein the data on the first incoming optical beam is stored in memory and thereafter the second incoming beam is reflected at said second selected one or ones of said modulator and/or detector pixels via the optical arrangement back to said second optical transmitter modulated according to the data on the first incoming optical beam stored in memory.

20. A method of addressing an array of AFP MQW pixels having first and second sets of electrodes comprising:

(a) scanning the first set of electrodes to detect any sensing current resulting from the photoactivation of a pixel while the second set of electrodes is scanned with a small negative voltage;

(b) if a pixel is detected in step (a) as being photoactivated, sampling any data received by the photoactivated pixel in handshaking protocol to determine whether a party photoactivating the photoactivated pixel is friend or foe;

(c) if the photoactivated pixel is turned on by a friend, applying a modulating voltage waveform to a corresponding electrode in the second set of electrodes corresponding photoactivated pixel; and

(d) if the photoactivated pixel is turned on by a foe, a voltage V., which is a zero reflection bias for the photoactivated pixel, is applied to a corresponding electrode in the second set of electrodes corresponding photoactivated pixel.

21. An optical apparatus comprising:

a two-dimensional array of modulator and/or detector pixels arranged in a hemispherical configuration, the modulator and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels; and

an optical arrangement for directing an incoming optical beam from an optical transmitter onto a selected one or ones of said modulator and/or detector pixels in said array and for returning light which is modulated and reflected by said pixels to an optical transmitter from which the incoming beam was directed to the optical arrangement.

22. The optical apparatus of claim 21 further including electronic equipment for sensing when light impinges on said pixels and for supplying data signals to said pixels to cause said pixels to reflect the impinging light in accordance with the data signals applied thereto.

23. The optical apparatus of claim 22 further including an associated electrical matrix for connecting the modulator and/or detector pixels in said array to the electronic equipment.

24. The optical apparatus of claim 21 wherein the array of modulator and/or detector pixels is an array of Asymmetric Fabry-Perot Multiple Quantum Well devices.

25. The optical apparatus of claim 24 wherein the optical arrangement is a lens which focuses the incoming beam onto said selected one or ones of said modulator and/or detector pixels in said array.

26. The optical apparatus of claim 21 wherein the hemispherical configuration is defined by a flexible or deformable body.

27. The optical apparatus of claim 26 wherein the flexible or deformable body is a thermosetting plastic.

28. The optical apparatus of claim 27 wherein the flexible or deformable body is a polymer.

29. The optical apparatus of claim 26 wherein the flexible or deformable body has a sheet-like polymer support element in which the two dimensional array of modulator and/or detector pixels are embedded.

30. The optical apparatus of claim 26 wherein the flexible or deformable body is relatively plastic at temperatures above room temperature, thereby allowing the flexible or deformable body and the array of modulator and/or detector pixels embedded therein to conform to said hemispherical configuration, while being relatively rigid at room temperature.

31. The optical apparatus of claim 21 wherein each modulator pixel comprises a plurality of AFP MQW devices.

32. The optical apparatus of claim 21 wherein each modulator pixel comprises at least one AFP MQW device and at least one optically activated switch connected in series with the at least one AFP MQW device.

33. The optical apparatus of claim 21 wherein each modulator pixel comprises at least one AFP MQW device and two optically activated switches connected in series with the at least one AFP MQW device.

34. The optical apparatus of claim 21 wherein the modulator and/or detector pixels are arranged in an array separated by pixel addressing electrodes arranged in a matrix, each modulator pixel having a pair of contacts for connection to separate adjacent addressing electrodes.

35. A method of optically repeating or relaying data comprising:

disposing a two-dimensional array of modulator and/or detector pixels in a predetermined configuration, the modulator and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels;

directing a first incoming optical beam from a first optical transmitter onto a first selected one or ones of said modulator and/or detector pixels in said array, the first incoming optical beam being modulated with data;

directing a second incoming optical beam from a second optical transmitter onto a second selected one or ones of said modulator and/or detector pixels in said arrays;

detecting the data on the first incoming optical beam; and

modulating the second incoming beam at said second selected one or ones of said modulator and/or detector pixels in said array using said data;

wherein the second incoming beam is reflected at said second selected one or ones of said modulator and/or detector pixels via the optical arrangement back to said second optical transmitter and is modulated by said data.

36. The method of claim 35 wherein the two dimensional array of modulator and/or detector pixels is disposed in a hemispherical configuration.

37. The method of claim 35 further including temporarily storing data received from one source and modulating a beam from another source with the temporarily stored data.

38. A method of optically relaying data comprising:

disposing a two dimensional array of modulator and/or detector pixels in a predetermined configuration, the modulator and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels;

directing a first incoming optical beam from a first optical transmitter onto a first selected one or ones of said modulator and/or detector pixels in said array, the first incoming optical beam being modulated with data;

directing a second incoming optical beam from a second optical transmitter onto a second selected one or ones of said modulator and/or detector pixels in said array;

storing the data on the first incoming optical beam in memory; and

modulating the second incoming beam at said second selected one or ones of said modulator and/or detector pixels in said array using said data stored in said memory,

wherein the second incoming beam is reflected at said second selected one or ones of said modulator and/or detector pixels via the optical arrangement back to said second optical transmitter.

39. A method of operating a Fabry-Perot multiple quantum well structure both as an optical modulator and as an optical detector by fixing a common electrical bias potential for both maximum detection performance when operating as a detector and optimum contrast ratio when operating as a modulator.

40. An optical apparatus comprising:

a two dimensional array of modulator and/or detector pixels embedded in a plurality of sub-wafers cooperatively arranged in a geometric shape, the modulator

and/or detector pixels responding to applied electrical signals to modulate and reflect light impinging the modulator and/or detector pixels; and

an optical arrangement for directing an incoming optical beam from an optical transmitter onto a selected one or ones of said modulator and/or detector pixels in said array and for returning light which is modulated and reflected by said pixels to an optical transmitter from which the incoming beam was directed to the optical arrangement.

41. The optical apparatus of claim 40 further including electronic equipment for sensing when light impinges on said pixels and for supplying data signals to said pixels to cause said pixels to reflect the impinging light in accordance with the data signals applied thereto.

42. The optical apparatus of claim 41 and an associated electrical matrix for connecting the modulator and/or detector pixels in said array to the electronic equipment.

43. The optical apparatus of claim 40 wherein the array of modulator and/or detector pixels is an array of Asymmetric Fabry-Perot Multiple Quantum Well devices.

44. The optical apparatus of claim 43 wherein the optical arrangement is a lens which focuses the incoming beam onto said selected one or ones of said modulator and/or detector pixels in said array.

45. The optical apparatus of claim 44 wherein the sub-wafers each have a generally flat polygonal configuration.

46. The optical apparatus of claim 45 wherein the geometric shape is a hemispherical, geodesic configuration.

47. The optical apparatus of claim 40 wherein the sub-wafers are a sheet-like plastic support element having a thickness at least 20 times that of an individual modulator pixel.

48. The optical apparatus of claim 40 wherein the sub-wafers are triangularly shaped.

49. The optical apparatus of claim 40 wherein each modulator pixel comprises a plurality of AFP MQW devices.

50. The optical apparatus of claim 40 wherein each modulator pixel comprises at least one AFP MQW device and at least one optically activated switch connected in series with the at least one AFP MQW device.

51. The optical apparatus of claim 40 wherein each modulator pixel comprises at least one AFP MQW device and two optically activated switches connected in series with the at least one AFP MQW device.

52. The optical apparatus of claim 40 wherein the modulator and/or detector pixels are arranged in an array separated by pixel addressing electrodes arranged in a matrix, each modulator pixel having a pair of contacts for connection to separate adjacent addressing electrodes.

53. An optical apparatus comprising:

(a) a two dimensional array of individually addressable modulator and/or detector pixels arranged in a geometric shape,

(b) an optical arrangement for directing an incoming optical beam from an optical transmitter onto a selected one or ones of said modulator and/or detector pixels in said array; and

(c) a control apparatus for individually controlling the individually addressable modulator and/or detector pixels to (i) reflect light which is modulated and reflected by said pixels when the optical beam is from an authorized or

friendly source and (ii) inhibit optical reflection by the individually addressable modulator and/or detector pixels when the optical beam is not from an authorized or friendly source.

54. The apparatus of claim 53 wherein the individually addressable modulator and/or detector pixels are each monolithic devices.

55. The apparatus of claim 53 wherein the individually addressable modulator and/or detector pixels are each asymmetric Fabry-Perot multiple quantum well devices.

56. The apparatus of claim 55 wherein the individually addressable asymmetric Fabry-Perot multiple quantum well devices each have at least two states of operation depending on how the individually addressable asymmetric Fabry-Perot multiple quantum well devices are controlled by the control apparatus, the at least two states including:

i. a detection state during which individually addressable asymmetric Fabry-Perot multiple quantum well devices reflect little or no light, but do detect the presence of incoming light, the control apparatus determining whether or not the incoming light detected by the individually addressable asymmetric Fabry-Perot multiple quantum well devices is from an authorized or friendly source; and

ii. a reflection state during which individually addressable asymmetric Fabry-Perot multiple quantum well devices modulate and reflect incoming light when the incoming light to the individually addressable asymmetric Fabry-Perot multiple quantum well devices is from one or more authorized or friendly sources as determined by the control apparatus.